

the first recessed area 1206. A circular groove 1207 extends about the periphery of the circular recessed area 1208. A slot 1204, having a shape generally conforming to a longitudinal profile of an MTU 160, is formed in the circular recessed area 1208 to one side of the center thereof. A short center post 1209 extends from the center of the circular recessed area 1208.

5 The rotating door 1220 is circular in shape and includes an axial wall 1222 extending about the periphery of the rotating door 1220. The axial wall 1222 is disposed a short radial distance from the outer peripheral edge of the rotating door 1220, thus defining an annular shoulder 1230 about the outermost peripheral edge outside the axial wall 1222. A slot 1226, having a shape generally conforming to the longitudinal profile of an MTU is formed in the rotating door 1220 at an off-center position.

10 The rotating door 1220 is installed into the circular recessed area 1208 of the end-wall 1202. A central aperture 1224 receives the center post 1209 of the end-wall 1202, and circular groove 1207 receives axial wall 1222. The annular shoulder 1230 rests on the flat surface of the recessed area 1206 surrounding the circular recessed area 1208.

15 The end-wall 1202 includes a drive gear recess 1210 which receives therein a drive gear 1212 attached to the drive shaft of a motor 1213 (See FIGURE 43 in which only the motor 1213 for the right side door assembly 1200 is shown). Motor 1213 is preferably a DC gear motor. A preferred DC gear motor is available from Micro Mo Electronics, Inc. of Clearwater, Florida, under model number 1524TO24SR 16/7 66:1. The outer circumference of the axial wall 1222 of the rotating door 1220 has gear teeth formed thereon which mesh with the drive gear 1212 when the shutter is installed into the circular recess 1208.

20 The cover plate 1232 is generally rectangular in shape and includes a raised area 1234 having a size and shape generally conforming to the recessed area 1206 of the end-wall 1202. Cover plate 1232 has formed therein an opening 1236 having a shape generally conforming to the longitudinal profile of an MTU, and, when the cover plate 1232 is installed onto the end-wall 1202, the raised rectangular area 1234 is received within the rectangular recessed area 1206 and opening 1236 is in general alignment with opening 1204. Thus, the rotating door 1220 is sandwiched between the cover plate 1232 and the end-wall 1202, and the openings 1236 and 1204 together define the entrance opening 1374 and exit opening 1376.

25 30 When the drive gear 1212 is rotated by the motor 1213, the rotating door 1220, enmeshed with the drive gear 1212, is caused to rotate about the center post 1209. When the opening 1226 is aligned with openings 1204 and 1236, MTUs 160 can be passed through the opening 1374

(1376) of the door assembly 1200. With the rotating door 1220 disposed within the circular recessed area 1208 and the raised area 1234 of the cover plate 1232 disposed within the recessed area 1206 of the end-wall 1202, a substantially light-tight structure is achieved, whereby little or no light enters through the door, when the opening 1226 is not aligned with openings 1204 and 1236.

Optical slotted sensors are disposed within slots 1214 and 1216 disposed on the outer edge of the circular recessed area 1208 at diametrically opposed positions. Preferred sensors are available from Optek Technology, Inc. of Carrollton, Texas, model number OPB857. The slotted sensors disposed within slots 1214 and 1216 detect the presence of a notch 1228 formed in the axial wall 1222 to signal door open and door closed status.

The optical sensor aperture shutter assembly 1250 is shown in FIGURE 45. A light receiver, such as a photomultiplier tube 956, is coupled with a light receiver opening 1254 formed in a light receiver mounting wall 1252. The light receiver mounting wall 1252 includes a generally rectangular, two-tiered raised area 1256, which defines a generally rectangular shoulder 1257 and a circular recessed area 1258 superimposed on the rectangular raised area 1256. A circular groove 1261 extends about the periphery of circular recessed area 1258. A center post 1259 is positioned at the center of the circular recessed area 1258. Light receiver opening 1254 is formed in the circular recessed area 1258. In the illustrated embodiment, the light receiver opening 1254 is disposed below the center post 1259, but the light receiver opening 1254 could be placed at any position within the circular recessed area 1258.

The aperture shutter assembly 1250 includes a rotating shutter 1270 having an axial wall 1274 with gear teeth formed on the outer periphery thereof. Axial wall 1274 is formed near, but not at, the outer periphery of the shutter 1270, thereby defining annular shoulder 1276. Rotating shutter 1270 is installed in the circular recessed area 1258 with center post 1259 received within a central aperture 1272 formed in the rotating shutter 1270 and with axial wall 1274 received within circular groove 1261. A drive gear 1262 disposed within a gear recess 1260 and coupled to a drive motor 1263 meshes with the outer gear teeth formed on the axial wall 1274 of the rotating shutter 1270 to rotate the rotating shutter 1270 about the center post 1259. A preferred drive motor 1263 is a DC gear motor available from Micro Mo Electronics, Inc. of Clearwater, Florida, as model number 1524TO24SR 16/7 66:1. Micro Mo gear motors are preferred because they provide a high quality, low backlash motor. An opening 1280 is formed in the rotating

shutter 1270 which can be moved into and out of alignment with light receiver opening 1254 as the rotating shutter 1270 is rotated.

With the shutter 1270 installed in the circular recessed area 1258, a cover plate, or sensor aperture wall, 1290 is installed onto the sensor mount 1252. As shown in FIGURE 45A, sensor aperture wall 1290 includes a generally rectangular, two-tiered recessed area 1296 which defines a generally rectangular shoulder 1297 and which is sized and shaped to receive therein the rectangular raised area 1256 of the sensor mount 1252. A sensor aperture 1292 is formed through the aperture wall 1290 and is generally aligned with the light receiver opening 1254 formed in the sensor mount 1252. The sensor aperture 1292 is generally in the shape of an elongated oval having a width generally corresponding to the width of an individual receptacle vessel 162 of an MTU 160 and a height corresponding to the height of the intended viewing area. Although opening 1280 of shutter 1270 is shown in the illustrated embodiment to be circular, opening 1280 can have other shapes, such as rectangular, with a width corresponding to the width of a receptacle vessel 162 or an elongated oval similar to sensor aperture 1292. Rotation of the rotating shutter 1270 to a position in which the opening 1280 is aligned with the light receiver opening 1254 and the sensor aperture 1292 permits light to reach the PMT 956, and rotation of the rotating shutter 1270 to a position in which the opening 1280 is not aligned with light receiver opening 1254 and sensor aperture 1292 prevents light from reaching the PMT 956.

Slotted optical sensors are disposed in slots 1264 and 1266 and detect a notch 1278 formed in the axial wall 1274 of the shutter 1270 to detect opened and closed positions of the shutter 1270. Preferred slotted optical sensors are available from Optek Technology, Inc., of Carrollton, Texas, as model number OPB857.

The aperture wall 1290 includes an upwardly facing shoulder 1294 extending across the width thereof. A downwardly facing shoulder of the MTU 160, defined by the connecting rib structure 164 of the MTU 160 (see FIGURE 58), is supported by the shoulder 1294 as the MTU 160 slides through the luminometer.

The receptacle vessel positioner assembly 1300 is shown in FIGURES 46 and 48-49. The receptacle vessel positioner 1304 is operatively disposed within the receptacle vessel positioner frame 1302. The receptacle vessel positioner 1304 is mounted in the receptacle vessel positioner frame 1302 for rotation about a shaft 1308. Shaft 1308 is operatively coupled to a rotary solenoid, or, more preferably, a gear motor 1306, to selectively rotate the receptacle vessel